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DIAGNOSTIC HARDWARE MANUAL

MAXA

SNOOPER

HARDWARE MANUAL

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THE SNOOPER DIAGNOSTIC BOARD

1-1 WHAT IS THE SNOOPER BOARD?

The Snooper board is a simple NuBus card used to test for some common hardware problems on a Macintosh. The Snooper Board will work with any NuBus Macintosh to detect problems with the power supply, the NuBus handshaking, and the ADB port. Machines that do not have a NuBus cannot be tested with The Snooper Board. This limitation does not, however, prevent you from using the Snooper Software to test a non-NuBus Macintosh. The major advantage The Snooper Board has over testing with the software is that the Snooper Board will still function even if the machine being tested is completely non-functional. This allows you to do some testing even on machines that are not healthy enough to load the software, or even display an image on the screen.

1-2 IS IT SAFE?

Snooper can help you save on diagnostic service costs by helping you to find the source of a malfunction and reducing the amount of technician time you have to pay for. It will help you to avoid taking a perfectly good computer in for service when the problem that seemed like a bad power supply turns out to be a new software virus that you picked up off a shareware disk. If you are a natural born tinkerer and don't blanch at the thought of pulling a bad power supply out of your machine and ordering a replacement, then by all means weigh the potential hazards posed by such an activity and consider making the repair yourself. If, however, you turn pale at the sight of uncovered electronics you probably should limit your use of the Snooper Board to saving unnecessary diagnostic costs, and leave the actual repair work to the experts. Apple-certified technicians have gone through two weeks of in-depth training from Apple Computer and, often, general electronics training. Apple Authorized dealers and service providers also maintain a large library of updated binders with repair instructions geared toward the service technician's advanced knowledge on the subject. They also have tools that most people do not have and do not know how to use.

Using the Snooper Board does not in any way endanger your manufacturers warranty, but tampering with parts on the computers' motherboard or other unsanctioned activities can. Because Apple Computer has done a good job of designing the NuBus based Macintoshes in a way that protects the users from the high voltage AC input, there is very little danger to you when using the Snooper Board. Most of the cautions provided are more for the protection of the computer than for your protection. While this type of product requires

some warnings and precautions, we hope that this parargraph will prove sufficient as a word to the wise. The remainder of this manual will be (as nearly as possible) devoid of disclaimers.

As long as you follow the instructions in this manual and take heed to the warnings provided in this manual, your experience with Snooper should be an enjoyable, educational, and economically rewarding one.

1-3 SNOOPER NUBUS CARD REQUIREMENTS

As the name indicates, the Snooper NuBus card requires a NuBus-equipped Macintosh such as the Mac II, IIcx, IIx, IIsi , IIci, IIfx, Quadra 700, and Quadra 900.

Note to Mac IIsi Owners

The Mac IIsi is equipped with an expansion adapter slot. If you have installed the optional NuBus Adaptor card in the Mac IIsi it is possible to use the Snooper diagnostic card. There are, however, two things about the configuration of the Mac IIsi that limit the usefulness of the Snooper diagnostic card with that machine. First, the orientation of the board in the machine makes it difficult to see the lights and the names of each light. Second, since you can only plug in one NuBus card at a time, Snooper tests that are testing for excessive current drain from a NuBus board are impossible.

1-4 DETAILS,DETAILS,DETAILS...

Before you use the Snooper hardware and software, fill out the warranty card and send it to Maxa. Without this card, Maxa will not be able to notify you when updates or upgrades are available. Also, take a few minutes to read the license agreement so you know your obligations.

USING THE SNOOPER BOARD

2-1 SNOOPER BOARD INSTALLATION

The following instructions explain how to install the Snooper NuBus card:

- Power off the computer and unplug the computer's power cable from the back of the computer.
- Open the case. Mac IIs of any model (II, IIcx, IIx, IIsi, IIci, IIfx, Quadra 700, Quadra 900) use a single screw to hold the computer's top tight during shipping and handling. Use a Phillips head screw driver to remove this single screw from the uppermost portion of the computers back.
- Remove the 'lid' to expose the 'guts' of the computer. There are two slightly protruding clips on the opposite sides of the lid itself. Depending on the model you own, these may vary slightly. Some of these clips are buttons that need to be depressed while removing the lid, such as those on the Mac II and IIfx. Others have tabs that need to be pulled upward when removing the lid. If you experience a problem with the lid removal process, please consult your Macintosh Users Manual.
- If you don't have an available slot in your system, remove the card that appears to be the smallest or the one with the fewest parts on it. Normally there is a direct relation between the size of the NuBus card and the amount of power it draws. If you remove the smallest card, you are likely to remove the card with the least propensity for causing power supply troubles with your Mac. Since that is just the sort of thing we are testing for, it's a good idea to leave in the "power hogs." After you follow through and test your Macintosh in this configuration, you may want to shut down the system and repeat the test process with a different card removed from the computer to make room for the Snooper Board.
- Discharge yourself of any static electricity that could damage the Snooper Board or the computer by touching the power supply of the Mac. This effectively "uses up" any static electricity stored in either you or the computer. Once you have touched the metal power supply case, there should be no danger of damaging anything with static electricity as long as you don't walk around on a carpet during the test. If you do move around during the test, be sure to touch the power supply again to discharge any static you may have generated.
- Pop out the plastic piece which covers the expansion slot opening on the back of the Macintosh with your finger. Don't worry, this piece can be snapped back in to cover the opening when you are finished with the Snooper card.

- Remove the Snooper card from its bag. Be careful not to take a walk around the house or office with the Snooper Board in your hand and out of its bag. Any static electricity you generate could damage the sensitive parts on the Snooper Board.
- Place the Snooper Board in an empty slot with the ADB port (closest to the 'PWR' Light) toward the back of the Macintosh. It is actually impossible to insert the card backward due to the clever design of the NuBus connector. If the board goes down into the slot, you have it in correctly. If it refuses to plug into the slot, it is probably because you are trying to plug it in backward.
- Plug the Snooper Board into the ADB connector of the computer. If you do not have a spare ADB cable (such as a keyboard cable) unplug the cable for your keyboard and use it. Once you have a cable and an empty ADB port, plug the Snooper Board into the ADB port the same way you would a keyboard. If your Macintosh has more than one ADB port, and you have a spare cable, it is best to leave the keyboard and mouse plugged in for the test. If you only have one port, or no spare cable, just do the test without the keyboard and mouse plugged in.
- Plug the computer back in and turn it on. If you removed the keyboard, you can use the power switch on the back of the computer to turn it on.
- Look at all the nifty lights on the Snooper Board! The next section will tell you all you need to know about all those lights and what they can tell you about your Macintosh. The Snooper board is used with the cover of the case removed so that the indicator lights that display the results of its tests can be viewed by the user.

2-2 WHAT DOES IT TEST?

The Snooper board tests the following aspects of any NuBus based Macintosh:

- +12 Volt power
- -12 Volt power
- + 5 Volt power
- NuBus Clock
- Bus Activity
- Apple Desktop Bus (ADB) data
- ADB power

2-3 USING THE QUICK REFERENCE CHART

The table below shows a reference you can use to quickly locate problems detected by Snooper. This table is provided for those who are confident enough in their Macintosh service knowledge, that they don't need to read the rest of the manual. You may not be one of those people and still don't want to read the rest of the manual. Do yourself a favor, read the manual anyway. After you understand what the tests are for, how to isolate problems, and how to find the remedies, you can knowledgeably use this quick reference as a guide for future tests.

To use the Quick Reference, look at one of the three groups of lights (the first three lights are the power supply lights, the second set of two lights are the NuBus lights, and the last two lights are the ADB lights) and see how they compare with that section of the table. The lights are all independent of each other with one exception. If the first light (+5V) is dim or off, both the computer and the Snooper Board are without power, and all bets are off on what you might see on the other lights. Without the +5 Volt power, the computer cannot put out anything intelligent for the other lights to monitor. Also, the Snooper Board will not be getting the power that it uses. In short, if the +5V light is not brightly lit, ignore all the other lights until the +5V problem has been found and solved.

2-4 THE QUICK REFERENCE CHART

♠ - Brightly lit.

♦ - Dimly lit.

• - Steady, continuous flash.

♣ - Irregular flash (occasional - sometimes rapid flashing).

♥ - Bright with occasional dimming or blinking.

* - Off.

≡ - Doesn't matter (any of the above conditions)

Power Supply Lights

+5V	+12V	-12V	Condition Identified
♠	♠	♠	Normal
*	*	*	Power supply dead or computer not turned on
♦	≡	≡	+5V is weak (see section **3-2**)
*	≡	≡	+5V is dead or below spec (see section **3-2**)
♥	≡	≡	+5V is weak and pulled down by occasional high power demand (see section **3-2**)
≡	♦	≡	+12V is weak (see section **3-3**)
≡	*	≡	+12V is dead or below spec (see section **3-3**)
≡	♥	≡	+12V is weak and pulled down by occasional high power demand (see section **3-3**)
≡	≡	♦	-12V is weak (see section **3-4**)
≡	≡	*	-12V is dead or below spec (see section **3-4**)
≡	≡	♥	-12V is weak and pulled down by occasional high power demand (see section **3-4**)
♦	♦	≡	an example of a combination of the above conditions - possibly both +5V and +12V are weak (see both sections listed above)

NuBus Lights

Clock	Activity	Condition Identified
•	♣	Normal
*	≡	NuBus Clock is dead (see section **3-5**)
♠	≡	NuBus Clock is dead (see section **3-5**)
≡	*	NuBus is locked up (see section **3-6**)
≡	♠	NuBus is locked up (see section **3-6**)

ADB Lights

ADB	PWR	Condition Identified
•	♠	Normal
*	≡	No ADB data (see section **3-7**)
♠	≡	No ADB data (see section **3-7**)
≡	♦	ADB power weak or bad cable (see section **3-8**)
≡	*	ADB power dead or low (see section **3-8**)
≡	♥	ADB power weak or bad cable (see section **3-8**)

HARDWARE ANALYSIS

3-1 INTRODUCTION

This chapter explains the significance of each light on the Snooper board in detail. It also discusses how they can be used to determine the condition of the Macintosh hardware under test.

This series of tests are unique in that they can find the most important failure modes of a Macintosh that won't boot and subsequently allow the use of software diagnostic tools. It quickly provides the user with information that would otherwise require several minutes of delicate probing with a meter or oscilloscope, and reference to several difficult to find manuals and schematics. In an instant, a technician or end user can see the results of this simple but revealing set of tests. This chapter is a detailed description of what can be determined by observation of the lights at the top of the Snooper board.

3-2 THE +5 VOLT LIGHT

As explained above, this should always be the first light that you look at on the Snooper Board simply because a malfunction of the +5V line will invalidate both the results given by the Snooper Board on the rest of its lights, and because if the +5V line of the computer is out of tolerance or dead, the computer will not be doing anything sensible, so the other tests are meaningless until the +5 volt problem has been solved. The +12V and -12V lights are, however, independent of the +5 volt line, and will still give an accurate indication of those voltages when +5 volts is malfunctioning.

This voltage is used heavily throughout the computer. Problems here will usually wreak havoc on the performance of the computer, as this is the line that supplies power to the microprocessor and RAM chips. As with the other power lights, this light should be at full brightness, and should not flicker at all as computer activity changes.

This light is connected via the NuBus to the +5 Volt line of the computer's power supply. The circuitry of the Snooper board is such that you can detect both low power and no power situations with this light. When all is well with the power supply, you should see full brightness in this light (approximately the same as the -12V and +12V lights). The circuitry is designed such that even with a slightly low voltage that is still marginally within the specifications, there will be a marked decrease in the brightness of the light. The light goes out completely at precisely the point where the voltage goes below the manufacturer's specifications.

Full brightness is the only normal condition of the light. When the light is dim it indicates that either the supply is weak or that there is excessive drain being placed on the +5V line

by the computer or a NuBus card or internal hard drive. While the computer may still operate in this condition it can cause random crashes and unexplained operation.

Narrowing it down

If there is a low voltage condition on the +5 Volt line (signaled by a dim light), it is often caused by power hungry or malfunctioning NuBus boards. Snooper can easily help you find the culprit by the process of elimination.

Another potential cause of excessive +5 Volt consumption in these days of Multi-Megabyte (RAM) Macintoshes is a collection of poorly designed 4 or 16 Megabyte RAM SIMMs used in conjunction with hungry NuBus cards. RAM is particularly hungry for +5 Volt power, and designs that squeeze an extraordinary number of RAM chips onto each SIMM instead of using higher density RAM chips, can easily create an excessive power demand on the +5 Volt line.

To see if the problem is a weak power supply or excessive drain:

- Turn off the computer.
- Unplug all NuBus cards (and any other possible sources of current draw such as Cache Cards, or accelerators), and leave Snooper installed. Also, if you have an internal hard drive installed in your Macintosh disconnect the power cable from the motherboard to the drive. This cable has four wires. The long, thin "ribbon" cable is the SCSI cable and does not need to be disconnected.
- Turn the computer on.

The light should be at full brightness now. If it isn't, either the power supply is weak or the Macintosh motherboard is failing in such a way as to draw too much current from the +5V line. A weak power supply is far more likely to be the cause of this problem, although a motherboard failure is possible.

If the +5V light returns to full brightness with NuBus boards removed and internal hard drives disconnected, the next step is to narrow down the culprit that is drawing excessive power from the supply.

Power Hungry NuBus Cards

Apple publishes limits on the acceptable power requirements of a NuBus board, but many manufacturers will "push the limit." They figure everything will be fine because other boards in the same computer will be manufactured within Apple's specifications and use less than the limit. If you try to use several of these power hungry boards in one computer, you can run into a situation where the power supply cannot maintain the correct voltage on the +5V line. Snooper can help you to determine which boards are power hungry and show you when you go over the power budget of your Macintosh.

The +5V light may return to full brightness when all NuBus and cache boards have been removed. The process of elimination can be employed to isolate the board that takes the power supply beyond its limits.

- Power off the Macintosh. (This is primarily for the safety of the computer and the NuBus boards, not your safety).
- Replace one of the boards that you removed earlier. The last one you should install is the largest board with the most chips on it. Connect the hard drive power cable last.
- Power on the Macintosh.

If the light remains at full brightness, repeat these steps until you find the card which causes the excessive drain. It is possible for a set of boards to take too much power from the supply even if there is no defect in the boards.

Internal Hard Drives

Hard drives also use +5 Volts. Subsequently, a large internal drive in a Mac that has room for one can add a substantial drain to this line. This can create a power supply problem, especially when a large drive is used in concert with power hungry NuBus cards. This applies only to internal hard drives. External drives do not use any power from the computer - they have their own supply.

If the light was still bright until you reconnected the hard drive, and then went dim, either the supply is defective, or it is taking the power supply just beyond its limit. To see if the drive is just the last straw needed to break the camels back, or if the drive is taking an abnormal amount of +5 volt power, try removing a NuBus card again to see if the light returns to the normal bright condition. If so, you know that it is just a situation where the machine is over-configured (i.e. it has more stuff connected to it than it can handle). If the light is still dim with one or two NuBus cards removed, then the hard drive is probably the culprit.

AC Power Brown Outs

Another use for the Snooper board would be to see if power brown outs on the AC line are sufficient to affect the output of the power supply. The supply is designed to maintain its output voltage even with a lowered input voltage (the AC power input), but if the AC line drops below a certain point, the ability of the supply to maintain its output voltages is hampered. If you operate a Macintosh in an area where power brownouts are common, you can use the Snooper board to monitor the power supply output to see if the brownouts are sufficient to cause a problem.

To see if power brown outs are affecting the computer, simply leave Snooper and all other NuBus cards installed and operate the computer normally. When a power brownout occurs, check the power lights on the Snooper Board. They should remain at full brightness during the brown out. If not, there is a good chance that the brown outs will eventually cause a system crash or flaky behavior. The only solution to this problem would be the purchase of a UPS (uninteruptable power supply, essentially a short term battery backup system).

3-3 THE +12 VOLT LINE

This light is connected via the NuBus to the +12 Volt line of the computer's power supply. As with the +5 volt light, you can detect both low power and no power situations with this light. When all is well with the power supply, you should see full brightness in this light (approximately the same as the -12V and +5V lights). The circuitry is designed such that even with a slightly low voltage that is still marginally within the specifications, there will be a marked decrease in the brightness of the light. The light goes out completely at precisely the point where the voltage goes below the manufacturer's specifications.

Full brightness is the only normal condition of the light. When the light is dim it indicates that either the supply is weak or that there is excessive drain being placed on the +12V line by the computer or a NuBus card or internal hard drive. While the computer may still operate in this condition it can cause random crashes and unexplained operation.

Not all functions of the computer use the +12 Volt supply. It is possible, therefore, for the computer to "limp along" with a marginal supply on this line, with only occasional glitches when a large power demand is placed on the +12 Volts. Serial port activity and disk drive access are often the most affected by this weakness.

Components that draw power from the +12V line are internal hard drives (probably the largest user), floppy drives (medium),NuBus cards(rare), the serial port drivers (small amount), and audio functions on some models.

Narrowing Down +12V Problems

To see if the problem is a weak power supply or excessive drain:

- Turn off the computer.
- Unplug all NuBus cards and disconnect the power cable from the motherboard to the internal hard drive. This cable has four wires. The long, thin "ribbon" cable is the SCSI cable and does not need to be disconnected.
- Turn the computer on.

Check to see if the +12V light has returned to full brightness. If it hasn't, either the power supply is weak or the Macintosh motherboard is failing in such a way as to draw too much current from the +12V line. A weak power supply is far more likely to be the cause of this problem, although a motherboard failure is possible.

If the +12V light returned to normal with NuBus boards removed and the disk drive disconnected, a simple process of elimination using the Snooper Board to monitor the results will quickly narrow down the culprit.

The +12V line can be a victim of "over-configuration" just like the +5V line. This is a situation where there is more stuff installed in the machine than the power supply can

handle. On the +12V line, this would most likely show up as an intermittent situation involving disk access. When the disk drive moves its head from one area of the disk to another it creates a brief but substantial power demand on the +12 volt line. If the power supply is already near its limit, this short burst of activity can momentarily take the supply beyond its limits.

Snooper can also help to detect this situation by continuously monitoring the +12 Volt line while the computer is in operation. If you suspect this problem, use the computer with Snooper installed and watch the light while disk access and other high power activity occurs. Any change in the brightness of the light suggests a potential problem.

This is because the power supply includes circuitry that instantaneously adjusts the voltage to keep it constant regardless of the amount of current being drawn. The only time a variation will occur is if the supply is not able to supply the current needed to maintain the exact correct voltage at its output. Thus, even a slight flicker in the light indicates either that the supply is faulty or that excessive power requirements are being placed on it.

The light brightness should be rock solid at all times. If, after all sources of power drain on the computer have been removed the +12V light is still dim, the supply is weak and should be replaced to assure proper operation.

NuBus cards and the +12V light

Apple publishes limits on the acceptable power requirements of a NuBus board, but some manufacturers may "push the limit." While this condition is more rare on the +12V line, it could occur. If you try to use several of these power hungry boards in one computer, you can run into a situation where the power supply is not able to maintain the correct voltage on the +12 Volt line. Snooper can help you to figure out which boards are power hungry and show you when you go over the power budget of your Macintosh.

The +12 Volt light may return to full brightness when all NuBus and cache boards have been removed. The process of elimination can be employed to isolate the board that takes the power supply beyond its limits.

- Power off the Macintosh.
- Replace one of the boards that you removed earlier. The last one you should install is the largest board with the most chips on it .
- Power on the Macintosh.

If the light remains at full brightness, repeat these steps until you find the card which causes the excessive drain. It is possible for a set of boards to take too much power from the supply even if there is no defect in the boards.

Hard Drives And The +12V light

Internal hard drives are usually the biggest user of the +12 Volt line. Subsequently, a large internal drive in a Mac that has room for one can add a substantial drain to this line. This can create a power supply problem, especially when a large drive is used in concert with power hungry NuBus cards. A malfunctioning hard drive can also draw too much current from the +12V line. This applies only to internal hard drives. External drives do not use any power from the computer - they have their own supply.

To isolate this possible problem, check the +12V light with the power cable for the disk drive disconnected. If the hard drive is causing the low voltage on the +12V line, the light should return to full voltage with the hard drive disconnected.

3-4 THE -12 VOLT LINE

This light, as its name implies, performs a function very similar to the +12V light (section **3-3**), except that it tests the computer's -12 Volt line. There is quite a bit of difference between the way the -12 Volt and +12 Volt lines are used within the computer. It would be *very* unlikely for a situation to exist where undamaged boards or disk drives would draw excessive power from the -12 Volt line.

While the power supply can supply only about 1/10th of the current to the -12 Volt line as it provides the +12 Volt line, it still generates far more than would ever be needed by properly functioning boards. If you see a dim light or a light that is completely off on this line, it is almost certainly a malfunctioning power supply, or NuBus board drawing an unreasonable amount of power from this line. The floppy drives and hard drives are not connected to the -12 volt supply, and are not culprits for a problem on this line.

Narrowing Down a -12 Volt Line Problem

One cause of this problem is for a short to occur somewhere on a NuBus board which would extinguish the -12V line completely. Another situation can occur when a malfunctioning component draws more than the normal amount of power from this line without killing it off completely. One common example of this is a leaky filter capacitor on a NuBus board or the motherboard. The same method of trial and error board removal used on +5V and +12V will identify the board that is killing off the -12V line. If all the NuBus boards have been removed and the -12V light is not at full brightness, the problem is either a short on the motherboard (very unusual), or the power supply needs to be replaced or repaired.

3-5 NUBUS CLOCK

This light monitors the heartbeat of the NuBus, the 10MHz clock that synchronizes the activity on the bus. The circuitry of this light is different from the voltage lights because the clock is a continuously changing signal, while the voltage lines are designed to send a steady unchanging DC signal.

Because of this difference, you shouldn't look for changes in brightness with the Clock light. You should look for the way that it flashes (or doesn't flash). In a properly functioning NuBus, the Clock light will exhibit a steady rapid flash. The speed of the flash is actually exactly 5 times per second. It is unusual for the speed to be wrong. It should also be steady and unchanging regardless of computer activity.

If the Clock light blinks erratically or stops occasionally, there is a major malfunction somewhere on the NuBus or motherboard.

Pinpointing a Clock Problem

Only two things can cause the Clock light to stay bright, stay dark, or blink in an erratic way: the source of the clock (a crystal controlled circuit on the Macintosh motherboard) is malfunctioning or there is a NuBus board that is killing the clock line. Snooper can help to determine which is the root cause by the process of elimination.

- Power off the Macintosh.
- Remove a NuBus card (with the power off).
- Turn the computer back on to see if the Clock light blinks properly. Repeat until all NuBus cards have been removed or the light flashes properly.

If a malfunctioning NuBus card has been identified, it should be returned to the manufacturer or the dealer from whom it was purchased for replacement or repair.

If all NuBus boards (except the Snooper board) have been removed from the bus and the Clock light is still not blinking steadily, the problem is on the Macintosh motherboard. There is only one fix for this: replace the motherboard. This would usually be done by an Apple Authorized service provider.

3-6 THE ACTIVITY LIGHT

This light shows activity over the NuBus. The normal condition for this light is difficult to describe since it changes depending on what the computer is doing. It is easier in this case to describe the two abnormal conditions. The abnormal conditions are 1) the light is always on, and 2) the light is always off. Any other type of flashing and bizarre activity is normal for this light. As with the Clock light above, the brightness or dimness of the light is of no consequence. The way in which the light flashes (or doesn't flash) determines the

status of this test. The normal condition for this light is an occasional flash, with very rapid blinking when certain types of computer activity are in progress. Movement of the mouse, for example, will create a rapid blinking condition on this light, as will disk activity.

NOTE: The Activity Light does not work correctly on Quadra 700 and Quadra 900 because of changes to theNuBus to support the NuBus 90 features on these machines.

The Causes Of Activity Light Abnormality

Trouble is signaled by either no activity on this light , or a continuously lit light. Each of these conditions denotes a problem on the bus. If either of these conditions exist, but the Clock light is normal, it is likely that a NuBus card is malfunctioning and has the bus "locked up."

The NuBus, like any situation where individual components are working together, requires that all those involved follow certain rules of behavior in order for some degree of decorum to exist. If one of the NuBus boards fails to follow this stringent code of bus conduct, it results in a technical condition known as "Grid Lock."

Isolating the Activity Abnormality

When this happens, one board prevents the other boards from using the bus, and all traffic in the computer comes to a screeching halt. The process of elimination should be used to discover which of the boards is misbehaving.

- Power off the Macintosh.
- Remove a NuBus card (with the power off).
- Turn the computer back on to see if the Activity light properly reacts to mouse movements or other system activity. Repeat until all NuBus cards have been removed or the light reacts properly.

If a malfunctioning NuBus card has been identified, it should be returned to the manufacturer or the dealer from whom it was purchased for replacement or repair. If all NuBus cards have been removed and the light still does not react to system activity, it is most likely a failure on the motherboard and will require a board swap (usually done by an Authorized Apple Technician). A major failure on an accelerator board can also kill the Activity light.

3-7 THE ADB DATA LIGHT

This light displays a modified version of the signal that travels over the ADB line to the keyboard and mouse and anything else connected to the ADB port. Most people would expect the light to show a change in characteristic when the keyboard or mouse are used. Actually, because of the type of signal that is used to communicate with the bus — PWM or Pulse Width Modulation — little or no visible change occurs on the ADB light as a result of mouse or keyboard activity.

Pulse Width Modulation

PWM is just a fancy way of saying that the information is transferred by changing the length of time the signal is high - before it goes low again. If it is high longer, it is low for a shorter time to make up for it, and the net result is a signal that has a constant frequency (how often it goes up and down), but a slight variation in the relationship between the time it is up and the time it is down. What it boils down to is that no matter what you do with the keyboard or the mouse, the only change in the light is an occasional delay of 0.00002 seconds in changing from off to on or vice versa. It doesnt matter how good your eyes are, you just can't see that! Very rapid mouse movement produces an almost imperceptible "dimming" of the light. It is actually not dimming at all, that is just the way your eye perceives the very slight reduction in the average amount of the time the light is on.

Whenever the Macintosh is on and functioning, it is constantly asking the keyboard and mouse (using PWM as described above) whether or not they have anything to talk about. It is a rather dreary conversation, very similar to that which goes on at a dull dinner party, but it gives the keyboard and mouse ample opportunity to provide the computer with the latest input from the user.

Since this exchange of information is constant, even when there is nothing happening with the keyboard or the mouse, the ADB light is supposed to blink constantly during the entire time the Macintosh is on. The primary usefulness of this light on the Snooper board is to see if this signal is there at all, not to determine the quality of the conversation going on between the keyboard, mouse, and computer. There are two basic causes for the ADB signal (and the ADB light) to stop flashing: a motherboard failure or an ADB device (keyboard or mouse, etc.) malfunction.

Narrowing Down An ADB Failure

The chip on the Macintosh mother board that creates the PWM signal described above is called the VIA (Versatile Interface Adapter). This chip handles all of the ADB communication and only bothers the microprocessor when there is user input to report. When something juicy comes in over the ADB port, the VIA interrupts the microprocessor so it can take appropriate action with the incoming data.

The rest of the time, the VIA just sits there and asks the keyboard "anything happening lately?" And asks the mouse "Que pasa?." If the VIA chip fails, the signal goes away completely and the light stops doing its characteristic blinking pattern. While the ensuing silence may be welcomed by the keyboard and mouse, it does prevent them from answering on those rare occasions when they do have some user input to report.

The test for this condition is very simple. If the keyboard and mouse are plugged in, disconnect them from the computer. If, with the keyboard, mouse, and any other ADB devices disconnected from the computer, there is still no blinking occurring on the ADB light, then the VIA chip is definitely not talking. If the VIA chip is the cause of the problem the motherboard must be replaced by an Apple Authorized service provider.

If, after disconnecting the ADB devices, the blinking of the ADB light resumes, the problem is a faulty ADB device. The potential for this problem has to do with the way in which the ADB devices answer the incessant question from the VIA chip. The signal that you see is originated by the VIA chip even when the keyboard or mouse is doing the talking.

The VIA chip queries the ADB device and then stops with the signal on the line held high (+5 Volts). The mouse or keyboard that is supposed to answer shorts out the line (in a very precise and controlled manner) to make the signal go up and down in a fashion very similar to that used by the VIA chip (see PWM above). This works fine if all of the ADB devices are functioning properly, but leaves the door wide open for a particularly nasty type of failure on the part of an ADB device.

If a keyboard or mouse continuously shorts this line out, it can make it appear that the VIA chip is not sending any signal. In fact, it is trying like the dickens to send its question out, but one of the ADB devices is shorting out the line. This malfunction makes all the other ADB devices connected to the computer useless until you find the malfunctioning device and remove it.

Finding a Malfunctioning ADB Device

It is not too difficult to see if this is the reason none of your ADB devices are talking to the computer and the reason the ADB light is not blinking.

While there is no high voltage on the ADB cable that would cause a safety risk to you if you decide to do the following procedure without turning off the computer, there is a small possibility of blowing a fuse that limits the supply current to the ADB devices (see the section below on the "PWR" light). In practice, this is very unlikely, but if you are a careful soul, go ahead and turn off the power whenever connecting or disconnecting ADB devices.

- Disconnect the keyboard, mouse, and any other devices hooked to an ADB port on the computer (leaving Snooper connected and the Mac on), and see if the ADB light begins to flash. If it does, then you know the problem is in one of the previously connected ADB devices.
- Plug one of the devices back in and watch the ADB light. If the light still flashes, plug in another one. Repeat this step until you have found the device(s) which causes the flash to cease.

If you have ADB devices that use a fully detachable cable such as a keyboard, make sure you test the cable with a compatible, properly functioning ADB device as well as any suspicious devices. This is to make sure that the short is in the device and not the cable. Devices with permanently attached cables, such as the standard Macintosh mouse, cannot be conveniently tested to isolate the cable from the device.

If you unplug all the devices and there is still nothing happening on the ADB light, you know that the VIA has stopped asking the devices on the bus for data. The motherboard must be replaced by an Apple Authorized service provider.

3-8 THE ADB POWER LIGHT - "PWR"

This Snooper light tests for the existence of power being supplied over the ADB to operate the keyboard, mouse, and any other ADB devices. The computer supplies +5 Volts over one of the four wires in the ADB cable, to provide power to all the ADB devices. This power is supposed to be present at all times when the computer is on.

The +5 Volt signal goes through a fuse on the Macintosh motherboard before it leaves the computer. Apple included this fuse to limit the damage to the computer when Tommy the two year old terror decides to pull the cable out of your keyboard and dunk it in your coffee cup to see what happens.

The fuse used on the motherboard is a fairly low value, and blows easily if the pins on the end of the ADB cable are accidentally shorted. Besides the above scenario, this can easily happen if the keyboard cable is connected to the computer at one end, and left laying disconnected at the other end. The metal part of a pen cap or some other metal object brushing across the exposed pins on the disconnected end of the cable is sufficient to blow the fuse. This is a fairly common cause of failure on the ADB.

Replacing The ADB Fuse

The aforementioned fuse is not of the "user replaceable" variety. It is a small yellow soldered fuse that looks a lot like a yellow resistor. It is usually less than an inch from one of the ADB connectors on the motherboard.

While it would be a serious indiscretion for us to recommend that end users might want to void their warranty and risk life and limb by replacing this soldered fuse on the motherboard, those with a technical bent might want to weigh the pros and cons of handling this problem without the aid of an Apple Authorized service provider. If the computer in question is out of warranty and you know enough to do the repair yourself or know someone who does, you can save yourself more than the cost of the Snooper Board by replacing it yourself. Otherwise the Mac should be returned to an authorized dealer for motherboard replacement or repair.

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